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(54) Viscosity index improver, dispersant and anti-oxidant additive and lubricating oil composition containing same.

(57) An additive composition having Viscosity Index improving, dispersant and anti-oxidant properties is prepared by graft polymerization on the polymer of 15 to 80 mole percent of ethylene, from 20 to 85 mole percent of C_3 - C_{10} alpha-monoolefin, and from 0 to 15 mole percent of non-conjugated diene or triene having an average molecular weight ranging from labout 5000 to 500,000. This polymer is reacted with at least one olefinic carboxylic acid acylating agent to form one or more acylating reaction intermediates having a carboxylic acid acylating function and the additive is formed by reacting said acylating function and the additive is formed by reacting said reaction intermediate with an amino-aromatic polyamine compound selected from an N-aryl-phenylenediamine, an aminothiazole, an aminocarbazole, an aminoindole, and aminopyrrole, an amino-indazolinone, an aminomercaptotriazole, and an aminoperimidine.

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NOVEL VI IMPROVER, DISPERSANT, AND ANTI-OXIDANT ADDITIVE AND LUBRICATING OIL COMPOSITION CONTAINING SAME

This invention relates to a novel multi-functional lubricant additive which is a VI improver, a dispersant and an anti-oxidant additive when employed in a lubricating oil composition.

The art contains many disclosures on the use of polymer additives in lubricating oil compositions. Ethylene-propylene copolymers and ethylene-alpha olefin non-conjugated diene terpolymers which have been further derivatized to provide bifunctional properties in lubricating oil compositions illustrate this type of oil additive.

U.S. 3,522,180 discloses a method for the preparation of an ethylene-propylene copolymer substrate effective as a viscosity index improver for lubricating oils.

U.S. 4,026,809 discloses graft copolymers of a methacrylate ester and an ethylene-propylene-alkylidene norbornene terpolymer as a viscosity index improver for lubricating oils.

U.S. 4,089,794 discloses ethylene copolymers derived from ethylene and one or more C_3 to C_{28} alpha olefin solution grafted with an ethylenically-unsaturated carboxylic acid material followed by a reaction with a polyfunctional material reactive with carboxyl, groups, such as a polyamine, a polyol, or a hydroxyamine which reaction product is useful as a sludge and varnish control additive in lubricating oils.

U.S. 4,137,185 discloses a stabilized imide graft of an ethylene copolymer additive for lubricants.

U.S. 4,146,489 discloses a graft copolymer where the backbone polymer is an oil-soluble ethylene-propylene copolymer or an ethylene-propylene-diene modified terpolymer with a graft monomer of C-vinylpyridine or N-vinylpyrrolidone to provide a dispersant VI improver for lubricating oils.

U.S. 4,320,019 discloses a multipurpose lubricating additive prepared by the reaction of an interpolymer of ethylene and a C_3 - C_8 alpha-monoolefin with an olefinic carboxylic acid acylating agent to form an acylating reaction intermediate which is then reacted with an amine.

U.S. 4,340,689 discloses a process for grafting a functional organic group onto an ethylene copolymer or an ethylene-propylene-diene terpolymer.

U.S. 4,358,250 discloses a reaction product of a copolymer and an olefin carboxylic acid via the "ene" reaction followed by a reaction with a monoamine-polyamine mixture.

U.S. 4,382,007 discloses a dispersant - VI improver prepared by reacting a polyamine-derived dispersant with an oxidized ethylene-propylene polymer or an ethylene-propylene diene terpolymer.

U.S. 4,144,181 discloses polymer additives for fuels and lubricants comprising a grafted copolymer reacted with a polyamine, polyol or hydroxyamine and finally reacted with a alkaryl sulfonic acid.

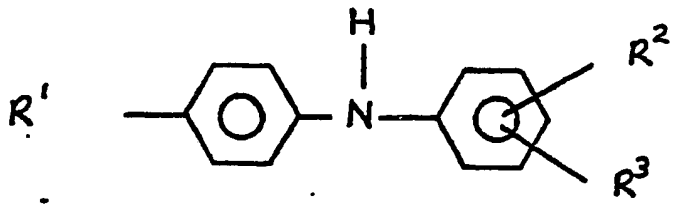
An object of this invention is to provide a novel derivatized graft copolymer composition.

Another object of the invention is to provide a multi-functional lubricant additive effective for imparting viscosity index, dispersancy and anti-oxidant properties to a lubricating oil composition.

A further object is to provide a novel lubricating oil composition containing the graft copolymer additive of the invention as well as to provide concentrates of the novel additive of invention.

The novel reaction product of the invention comprises an ethylene copolymer or terpolymer of a C_3 to C_{10} alpha-monoolefin and optionally a non-conjugated diene or triene on which has been grafted an ethylenically unsaturated carboxylic function which is then further derivatized with an amino-aromatic polyamine compound from the group consisting of:

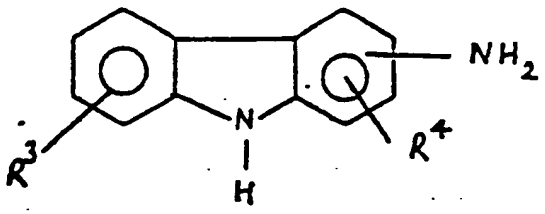
a) an N-arylphenylenediamine represented by the formula:



in which R^1 is H, -NHaryl, -NHaralkly, or branched or straight chain radical having from 4 to 24 carbon atoms that can be alkyl, alkenyl, alkoxyl, aralkyl alkaryl, hydroxyalkyl or aminoalkyl,
R^2 is NH_2, CH_2-$(CH_2)_n$-NH_2 or CH_2-aryl-NH_2 in which n has a value from 1 to 10
R3 is alkyl, alkenyl, alkoxyl, aralkyl, alkaryl, having from 4 to 24 carbon atoms,

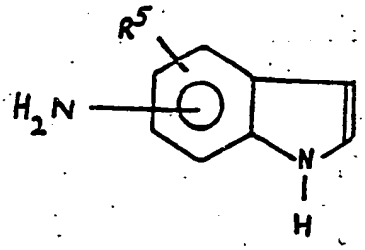
b) an aminothiazole from the group consisting of aminothiazole, aminobenzothiazole, aminobenzothiadiazole and aminoalkylthiazole,

c) an aminocarbazole represented by the formula:



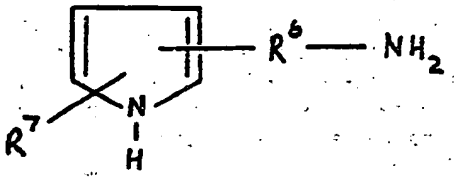
in which R^3 and R^4 represent hydrogen or an alkyl or alkenyl, radical having from 1 to 14 carbon atoms,

d) an aminoindole represented by the formula:



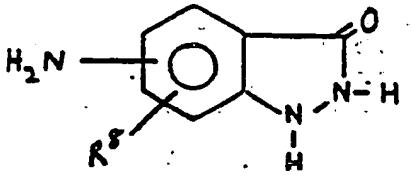
in which R^5 represents hydrogen or an alkyl radical having from 1 to 14 carbon atoms

e) an aminopyrrole represented by the formula:



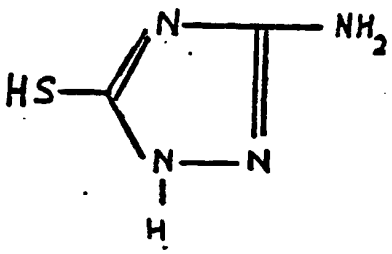
in which R^6 is a divalent alkylene radical having 2-6 carbon atoms and R^7 hydrogen or an alkyl radical having from 1 to 14 carbon atoms,

f) an amino-indazolinone represented by the formula:

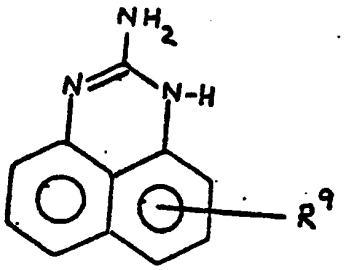


in which R^8 is hydrogen or an alkyl radical having from 1 to 14 carbon atoms

g) an aminomercaptotriazole represented by the formula:



h) and an aminoperimidine represented by the formula,



in which R^9 represents hydrogen or an alkyl radical having from 1 to 14 carbon atoms, and

The novel lubricant of the invention comprises an oil of lubricating viscosity and an effective amount of the novel reaction product. The lubricating oil will be characterized by having viscosity index improver and dispersancy, anti-oxidant properties.

Concentrates of the reaction product of the invention are also contemplated.

The polymer or copolymer substrate employed in the novel additive of the invention may be prepared from ethylene and propylene or it may be prepared from ethylene and a higher olefin within the range of C_3 to C_{10} alpha-monoolefins.

More complex polymer substrates, often designated as interpolymers, may be prepared using a third component. The third component generally used to prepare an interpolymer substrate is a polyene monomer selected from non-conjugated dienes and trienes. The non-conjugated diene component is one having from 5 to 14 carbon atoms in the chain. Preferably, the diene monomer is characterized by the presence of a vinyl group in its structure and can include cyclic and bi-cyclo compounds. Representative dienes include 1,4-hexadiene, 1,4-cyclohexadiene, dicyclopentadiene, 5-ethylidene-2-norbornene, 5-methylene-2-norbornene 1,5-heptadiene, and 1,6-octadiene. A mixture of more than one diene can be used in the preparation of the interpolymer. A preferred non-conjugated diene for preparing a terpolymer or interpolymer substrate is 1,4-hexadiene.

The triene component will have at least two non-conjugated double bonds, and up to 30 carbon atoms in the chain. Typical trienes useful in preparing the interpolymer of the invention are 1-isopropylidene-3a,4,7,7a-tetrahydroindene, 1-isopropylidenedicyclopentadiene, dehydro-iso-dicyclopentadiene, and 2-(2-methylene-4-methyl-3-pentenyl)-[2.2.1] bicyclo-5-heptene.

The polymerization reaction to form the polymer substrate is generally carried out in the presence of a catalyst in a solvent medium. The polymerization solvent may be any suitable inert organic solvent that is liquid under reaction conditions for solution polymerization of monoolefins which is generally conducted in the presence of a Ziegler type catalyst. Examples of satisfactory hydrocarbon solvents include straight chain paraffins having from 5-8 carbon atoms, with hexane being preferred. Aromatic hydrocarbons, preferably aromatic hydrocarbons having a single benzene nucleus, such as benzene, toluene and the like; and saturated cyclic hydrocarbons having boiling point ranges approximating those of the straight chain paraffinic hydrocarbons and aromatic hydrocarbons described above, are particularly suitable. The solvent selected may be a mixture of one or more of the foregoing hydrocarbons. It is desirable that the solvent be free of substances that will interfere with a Ziegler polymerization reaction.

In a typical preparation of a polymer substrate, hexane is first introduced into a reactor and the temperature in the reactor is raised moderately to about 30° C. Dry propylene is fed to the reactor until the

pressure reaches 40-45 inches of mercury (135.5 to 152.4KPa). The pressure is then increased to about 60 inches of mercury (203.2KPa) and dry ethylene and 5-ethylidene-2-norbornene are fed to the reactor. The monomer feeds are stopped and a mixture of aluminum sesquichloride and vanadium oxytrichloride are added to initiate the polymerization reaction. Completion of the polymerization reaction is evidenced by a drop in the pressure in the reactor.

Ethylene-propylene or higher alpha monoolefin copolymers may consist of from 15 to 80 mole percent ethylene and from 20 to 85 mole percent propylene or higher monoolefin with the preferred mole ratios being from 25 to 75 mole percent ethylene and from 25 to 75 mole percent of a C_3 to C_{10} alpha monoolefin with the most preferred proportions being from 25 to 55 mole percent ethylene and 45 to 75 mole percent propylene.

Terpolymer variations of the foregoing polymers may contain from 0.1 to 10 mole percent of a non-conjugated diene or triene.

The polymer substrate, that is the ethylene copolymer or terpolymer is an oil-soluble, substantially linear, rubbery material having an average molecular weight from 5,000 to 500,000 with a preferred molecular weight range of 25,000 to 250,000 and a most preferred range from 50,000 to 150,000.

The terms polymer and copolymer are used generically to encompass ethylene copolymers, terpolymers or interpolymers. These materials may contain minor amounts of other olefinic monomers so long as their basic characteristics are not materially changed.

An ethylenically unsaturated carboxylic acid material is next grafted onto the prescribed polymer backbone. These materials which are attached to the polymer contain at least one ethylenic bond and at least one, preferably two, carboxylic acid or its anhydride groups or a polar group which is convertible into said carboxyl groups by oxidation or hydrolysis. Maleic anhydride or a derivative thereof is preferred. It grafts onto the ethylene copolymer or terpolymer to give two carboxylic acid functionalities. Examples of additional unsaturated carboxylic materials include chlormaleic anhydride, itaconic anhydride, or the corresponding dicarboxylic acids, such as maleic acid, fumaric acid and their monoesters.

The ethylenically unsaturated carboxylic acid material may be grafted onto the polymer backbone in a number of ways. It may be grafted onto the backbone by a thermal process known as the "ene" process or by grafting in solution or in solid form using a radical initiator. The free-radical induced grafting of ethylenically unsaturated carboxylic acid materials in solvents, such as benzene is a preferred method. It is carried out at an elevated temperature in the range of 100°C. to 250°C, preferably 120° to 190°C and more preferably at 150° to 180°C, e.g. above 160°C, in a solvent, preferably a mineral lubricating oil solution containing, e.g. 1 to 50, preferably 5 to 30 wt.%, based on the initial total oil solution, of the ethylene polymer and preferably under an inert environment.

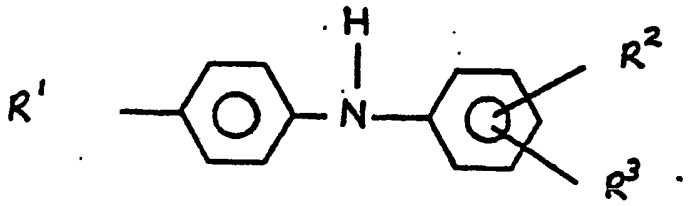
The free-radical initiators which may be used are peroxides, hydroperoxides, and azo compounds and preferably those which have a boiling point greater than 100°C and decompose thermally within the grafting temperature range to provide free radicals. Representative of these free-radical initiators are azobutyronitrile and2-,5-dimethyl-hex-3-yne-2,5 bis-tertiary-butyl peroxide. The initiator is used in an amount of between 0.005% and 1% by weight based on the weight of the reaction mixture solution. The grafting is preferably carried out in an inert atmosphere, such as under nitrogen blanketing. The resulting polymer intermediate is characterized by having carboxylic acid acylating functions within its structure.

In the solid or melt process for forming a graft polymer, the unsaturated carboxylic acid with the optional use of a radical initiator is grafted on molten rubber using rubber masticating or shearing equipment. The temperature of the molten material in this process may range from 150-400°C.

Polymer substrates or interpolymers are available commercially. Particularly useful are those containing from 40 to 60 mole percent ethylene units, and 60 to 40 mole percent propylene units. Examples are "Ortholeum 2052" and "PL-1256" available from E.I. duPont deNemours and Co. The former is a terpolymer containing about 48 mole percent ethylene units, 48 mole percent propylene units and 4 mole percent 1,4-hexadiene units, having an inherent viscosity of 1.35. The latter is a similar polymer with an inherent viscosity of 1.95. The viscosity average molecular weights of the two are of the order of 200,000 and 280,000, respectively.

The polymer intermediate possessing carboxylic acid acylating functions is reacted with an amino-aromatic polyamine compound from the group consisting of:

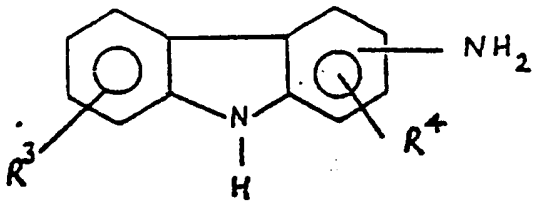
a) an N-arylphenylenediamine represented by the formula:



in which R^1 is hydrogen, -NH-Aryl, -NH-Aralkyl, a branched or straight chain radical having from 4 to 24 carbon atoms that can be alkyl, alkenyl, alkoxyl, aralkyl, alkaryl, hydroxyalkyl or aminoalkyl
R^2 is NH_2, CH_2-$(CH_2)_n$-NH_2, CH_2-aryl-NH_2, in which n has a value from 1 to 10, and R^3 is alkyl, alkenyl, alkoxyl, aralkyl, alkaryl having from 4 to 24 carbon atoms

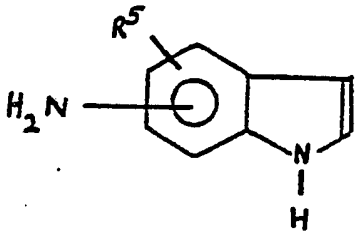
b) an aminothiazole from the group consisting of aminothiazole, aminobenzothiazole, amionbenzothiadiazole and aminoalkylthiazole

c) an aminocarbazole represented by the formula:



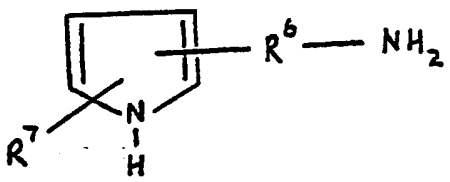
in which R and R^1 represent hydrogen or an alkyl, alkenyl, or alkoxyl radical having from 1 to 14 carbon atoms

d) an aminoindole represented by the formula:



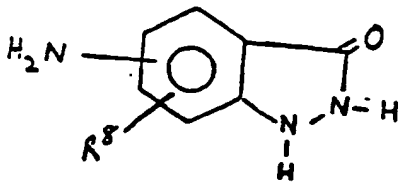
in which R represents hydrogen or an alkyl radical having from 1 to 14 carbon atoms

e) an aminopyrrole represented by the formula:



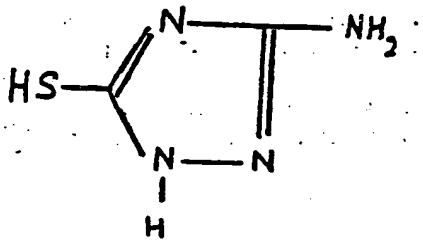
in which R is a divalent alkylene radical having 2-6 carbon atoms and R^1 is by hydrogen or an alkyl radical having from 1 to 14 carbon atoms

f) an amino-indazolinone represented by the formula:

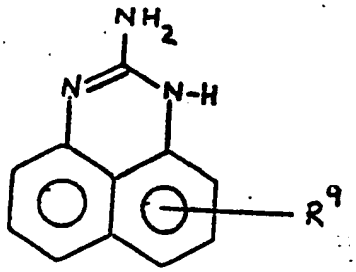


in which R is hydrogen or an alkyl radical having from 1 to 14 carbon atoms

g) an aminomercaptotriazole represented by the formula:



h) an aminoperimidine represented by the formula:



in which R represents hydrogen or an alkyl alkenyl or alkoxyl radical having from 1 to 14 carbon atoms.

Particularly preferred N-arylphenylenediames are the N-phenylphenylenediamines, for example, N-phenyl-1,4-phenylenediamine, N-phenyl-1,3-phenylenediamine, and N-phenyl-1,2-phenylenediamine.

The reaction between the polymer substrate intermediate having grafted thereon carboxylic acid acylating function and the prescribed amino-aromatic polyamine compound is conducted by heating a solution of the polymer substrate under inert conditions and then adding the amino-aromatic polyamine compound to the heated solution generally with mixing to effect the reaction. It is convenient to employ an oil solution of the polymer substrate heated to 140 to 175° C. while maintaining the solution under a nitrogen blanket. The amino-aromatic polyamine compound is added to this solution and the reaction is effected under the noted conditions.

The following examples illustrate the preparation of the novel reaction product additive of the invention.

Example 1

60 grams of a solid maleic anhydride graft polymer (rubber) in which the polymer substrate consisted of about 58 mole percent ethylene and 42 mole percent propylene having an average molecular weight of 80,000 on which has been grafted 1.5 weight percent of maleic anhydride was dissolved in 485 grams of solvent neutral oil at 160° C. with mechanical stirring while the mixture was maintained under a nitrogen blanket. After the rubber polymer had dissolved, mixing was continued for an additional hour at 160° C.

1.85 grams of neat N-phenyl-1,4-phenylenediamine was added to the oil solution of the polymer and a reaction effected over 4 hours at 160° C under nitrogen. The reaction mixture containing the derivatized

graft polymer was then cooled and filtered.

Example II

70 grams of a solid maleic anhydride graft polymer rubber in which the polymer substrate consisted of about 58 mole percent ethylene and 42 mole percent propylene having on average molecular weight of 80,000 on which has been grafted 0.7 weight percent of maleic anhydride was dissolved in 513 grams of solvent neutral oil at 160° C. with mechanical stirring while the mixture was maintained under a nitrogen blanket. After the polymer had dissolved, mixing was continued for an additional 3 hours at 160° C.

1.1 grams of neat N-phenyl-1,4-phenylenediamine was added to the oil solution of the polymer and a reaction effected over 3 hours at 160° C under nitrogen. The reaction mixture containing the derivatized graft polymer was cooled and then filtered through a 100 mesh screen.

Example III to VIII

Derivatized graft polymers are prepared employing the polymer and procedures shown in Example I employing the following amino-aromatic polyamines

Example III	Aminothiazole
Example IV	Aminocarbazole
Example V	Aminoindole
Example VI	Aminoperimidine
Example VII	Aminopyrrole
Example VIII	Aminomercaptotriazole
Example IX	N-phenyl-1,3-phenylenediamine

The novel graft and derivatized polymer of the invention is useful as an additive for lubricating oils. They are muli-functional additives for lubricants being effective to provide dispersancy, viscosity index improvement and anti-oxidant properties to lubricating oils. They can be employed in a variety of oils of lubricating viscosity including natural and synthetic lubricating oils and mixtures thereof. The novel additives can be employed in crankcase lubricating oils for spark-ignited and compression-ignited internal combustion engines. The compositions can also be used in gas engines, or turbines, automatic transmission fluids, gear lubricants, metal-working lubricants, hydraulic fluids and other lubricating oil and grease compositions. Their use in motor fuel compositions is also contemplated.

The base oil may be a natural oil including liquid petroleum oils and solvent-treated or acid-treated mineral lubricating oils of the paraffinic, naphthenic and mixed paraffinic-naphthenic types.

In general, the lubricating oil composition of the invention will contain the novel reaction product in a concentration ranging from 0.1 to 30 weight percent. A preferred concentration range for the additive is from 1 to 15 weight percent based on the total weight of the oil composition.

Oil concentrates of the additives may contain from 1 to 50 weight percent of the additive reaction product in a carrier or dilvent oil of lubricating oil viscosity.

The novel reaction product of the invention may be employed in lubricant compositions together with conventional lubricant additives. Such additives may include additional dispersants, detergents, anti-oxidants, pour point depressants, anti-wear agents and the like.

The novel additive reaction product of the invention was tested for its effectiveness as a dispersant and as an anti-oxidant in a formulated lubricating oil composition. In all of the examples, the polymer substrate was similar comprising about 58 mole percent ethylene, 42 mole percent propylene having an average molecular weight of about 80,000. The base lubricating oil used in the dispersancy test was a typical formulated lubricating oil as represented by the values set forth in Table I.

TABLE I

Component	Parts By Wgt.
Solvent neutral oil A	75.25
Solvent neutral oil B	21.64
Zinc Dialkyldithioposphate	1.22
4.4'dinonyldiphenylamine	.39
Overbased magnesium sulfonate	1.50
Silicone anifoamant	150 PPM
Product	10
Analyses	
Viscosity Kin 40°C CS	30.4
Viscosity Kin 100°C CS	5.33
Pour Point, °F.(°C)	+10 (-12)
Ash Sulfated, % D874	0.88
Phosphorus, % X-Ray	0.12
Sulfur, % X-Ray Total	0.32
Zinc, % X-Ray	0.13

oil A had a sp. gr. 60/60°F (15.5/15.5°C) of 0.858-0.868; Vis 100°F (38°C) 123-133 SUS(26 to 29 CS; Pour Point 0°F (-18°C). Oil B had a sp. gr. 60/60°F. (15.5/15.5°C) of 0.871-0.887; Vis. 100°F (38°C) 325-350 SUS(70 to 75 CS); Pour Point +10°F (-12°C). Zinc salt is a salt of mixed alcohols-isopropanol and P_2S_5 product as described in U.S. Pat. No. 3,292,181. The overbased magnesium sulfonate had a TBN of 395 and is a salt of branched C_{20}-C_{40} monoalkybenzene sulfuric acid (MW 530-540) together with about 10% magnesium carbonate, 14% magnesium hydroxide and 4% magnesium sulfate.

The dispersant properties of the additive-containing oil are determined in the Bench VC Dispersancy Test (BVCT). Dispersancy of a lubricating oil is determined relative to three references which are the results from three standard blends testing along with the unknown. The test additives were blended into a formulated oil containing no dispersant. The additive reaction product was employed in the oil at a

concentration of 1.20 weight percent polymer solution. The numerical value of the test results decreases with an increase in effectiveness.

TABLE II

BENCH VC DISPERANCY TEST	
Additive	Result
Example 1	27
Example 2	27
Ethylene-propylene copolymer	99
Commercial N-vinylpyrrolidene grafted dispersant olefin copolymer	29

The anti-oxidant properties of the novel reaction product in a lubricating oil was determined in the Bench Oxidation Test. In this test, 1.5 weight percent of the additive reaction product is blended into solvent neutral oil 130(S.U.S. 28C5) at 100°F(38°C). The mixture is continuously stirred while being heated accompanies by bubbling with air. Samples are withdrawn periodically for analysis by Differential Infrared Absorption (DIR) to observe changes in the intensity of the carboxyl vibration band at 1710 cm-1. A low carboxyl vibration band intensity indicates higher thermal-oxidative stability of the sample.

TABLE III

BENCH OXIDATION TEST	
Additive	Result
Example I	3
Example II	10
Ethylene-propylene copolymer (EPM)	15
Maleic anhydride grafted (EPM)	27
Commercial N-vinylprrolidene grafted dispersant olefin Copolymer (DOCP)	15

The test results for Example I and II demonstrate substantial improvements in anti-oxidant properties due to incorporation of the novel reaction product of the invention in an oil composition as compared to the results obtained from known VI and dispersant VI improvers. The result for Example I was particularly outstanding.

The novel polymers may also be characterized as deposit protection agents as measured by the Single Cylinder CEC MWM-B Diesel Engine Test (DIN 51361 Parts I, II, and IV). In this test, a solution (8.5 wt. %) of polymer in SNO-100 oil is blended into a fully formulated oil which does not contain a VI improver. Results are presented in "Merits", a higher merit evidencing better protection against deposits. The results are set forth in Table IV below.

TABLE IV

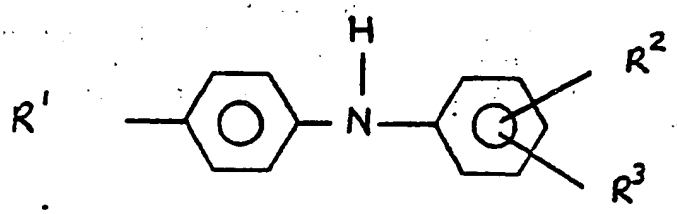
ENGINE TEST PERFORMANCE			
Engine Tests	VI Improvers		
	NVP-EPM	DMAPA/MA-EPM	Example I
MWM-B, SAE 15w-40 MO			
Merits	53	59	63
Sequence VE, SAE 5w-30 MO			
Avg. Sludge	6.4	7.6	8.8
Avg. Varnish	5.2	6.2	6.8
Piston Skirt Varnish	6.9	7.0	7.6
Cam Lobe Wear, Mils (μm)			
Max	19.2(488)	9.7(246)	6.5 (165)
Avg.	4.8(122)	7.9(201)	2.3 (58)
NVP-EPM = N-Vinyl pyrrolidone grafted ethylene propylene copolymer DMAPA/MA-EPM: Maleic Anhydride grafted ethylene propylene copolymer derivatized with N-dimethylaminopropylamine.			

The motor oil composition containing reaction product of Example I exhibited outstanding engine cleanlines as compared to known grafted and derivatized polymers.

Claims

1. A method for preparing a lubricant additive composition by reacting a polymer comprising from 15 to 80 mole percent of ethylene, from 20 to 85 mole percent of a C_3 - C_{10} alpha-monoolefin, and from 0 to 15 mole percent of a polyene selected from non-conjugated dienes and trienes said polymer having an average molecular weight of 5,000 to 500,000 with at least one olefinic carboxylic acid acylating agent to form one or more reaction intermediates having a carboxylic acid acylating function within their structure, and reacting said reaction intermediate with a polyfunctional material reactive with carboxyl groups, characterised in that the polyfunctional material is an amino-aromatic polyamine compound selected from

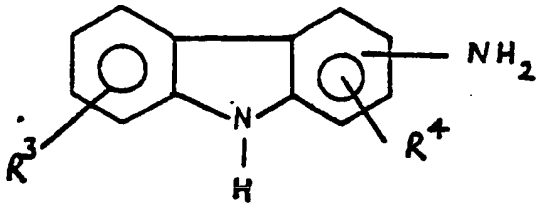
a) an N-arylphenylenediamine having the formula:



in which R^1 is hydrogen, NH-aryl, NH-aralkyl, or a branched or straight chain group having 4 to 24 carbon atoms that can be alkyl, alkenyl, alkoxyl, aralkyl, alkaryl hydroxyalkyl or aminoalkyl,
R^2 is NH_2, CH_2-$(CH_2)_n$-NH_2, or CH_2-aryl-NH_2 in which n is 1 to 10,
and R^3 is alkyl, alkenyl, alkoxyl, aralkyl, or alkaryl having 4 to 24 carbon atoms,

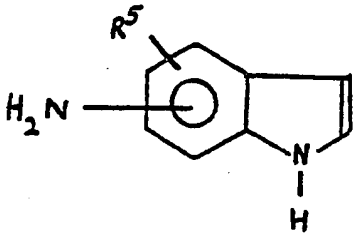
b) an aminothiazole selected from aminothiazole, aminobenzothiazole, aminobenzothiadiazole and aminoalkylthiazole,

c) an aminocarbazole having the formula:



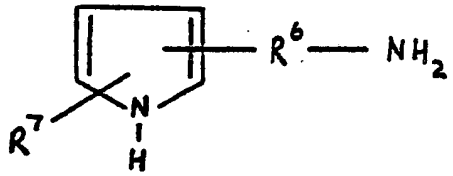
in which R^3 and R^4 are each hydrogen or alkyl or alkenyl, having 1 to 14 carbon atoms,

d) an aminoindole having the formula:



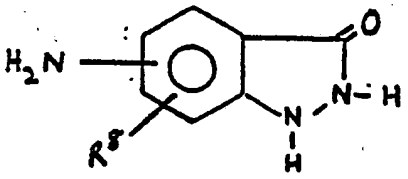
in which R^5 is hydrogen or alkyl having 1 to 14 carbon atoms,

e) an aminopyrrole having the formula:



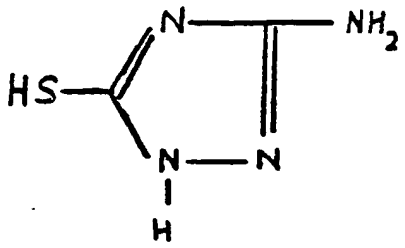
in which R^6 is alkylene having 2 to 6 carbon atoms and R^7 is hydrogen or alkyl having 1 to 14 carbon atoms,

f) an amino-indazolinone having the formula:



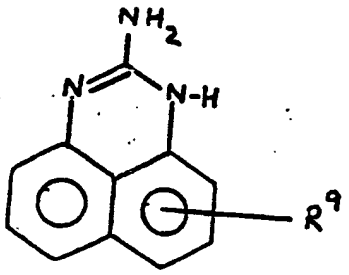
In which R^8 is hydrogen or alkyl having 1 to 14 carbon atoms,

g) an aminomercaptotriazole having the formula:



and

h) an aminoperimidine having the formula:



in which R^8 is hydrogen or alkyl, alkenyl, or alkoxyl having 1 to 8 carbon atoms.

2. A method according to Claim 1 characterised in that the polymer has an average molecular weight from 25,000 to 250,000.

3. A method composition according to Claim 1 or 2 characterised in that the polymer comprises from 25 to 75 mole percent of ethylene and from 25 to 75 mole percent of a C_3 to C_8 alpha-monoolefin.

4. A method according to any one of Claims 1 to 3 characterised in that the polymer comprises 0.1 to 10 mole percent of a polyene.

5. A method according to any one of Claims 1 to 4 characterised in that the olefinic carboxylic acid acylating agent is maleic anhydride or itaconic anhydride.

6. A method according to any one of Claims 1 to 5 characterised in that the amino-aromatic polyamines is an N-phenylphenylenediamine or aminothiazole.

7. A method according to any one of Claims 1 to 5 characterised in that the amino-aromatic polyamine is N-phenyl-1, 4-phenylene diamine or N-phenyl-1, 3-phenylene diamine.

8. A lubricating oil composition comprising a major amount of an oil of lubricating viscosity and a minor amount effective to impart viscosity index, dispersancy, and anti-oxidant properties to said oil of an additive composition prepared by a method according to any one of Claims 1 to 7.

9. A lubricating oil composition according to Claim 8 characterised by containing from 0.1 to 30.0 weight percent of said additive, based on the total weight of the oil composition.

10. A concentrate for a lubricating oil comprising a diluent oil of lubricant viscosity and from 1 to 50 weight percent, based on the total weight of the concentrate, of an additive composition prepared by a method according to any one of Claims 1 to 7.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 89 30 2472

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	EP-A-0 002 286 (ROHM AND HAAS CO.) * Page 4, line 32 - page 5, line 18; page 6, lines 25-34; page 11, line 14 - page 12, line 27; page 15, line 24 - page 16, line 28 *	1-6,8-10	C 10 M 143/02 C 10 M 149/06 C 10 M 149/10 C 10 M 151/02 C 08 F 255/00 // C 10 N 30:02 C 10 N 30:04 C 10 N 30:10
A	---	7	
D,A	US-A-4 320 019 (THE LUBRIZOL CORP.) * Column 1, line 65 - column 2, line 30; column 3, lines 14-18; column 4, lines 33-59; column 4, line 62 - column 6, line 14; column 6, line 59 - column 7, line 5 *	1-10	

D,A	US-A-4 144 181 (R.L. ELLIOTT et al.) * Column 2, lines 32-65; column 3, line 55 - column 4, line 21; column 4, line 40 - column 7, line 16 *	1-10	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

C 10 M
C 08 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22-06-1989	HILGENGA K.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

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